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BLOOD SUCKING AMONG PHYTOPHAGOUS HEMIPTERA

BY R. L. USINGER,

Oakland, California.

In a recent paper by Dr. J. G. Meyers (1929) entitled "Faculative Blood-Sucking in Phytophagous Hemiptera" an excellent summary of our knowledge of this interesting phenomenon is given. The above cited paper, and others listed in the bibliography at the conclusion of the present paper, recalled to mind certain experiences and observations made in collecting these insects during the past few years. It was found that new records could be added from these data and several additional titles could be added to the rather extensive bibliography of Meyers (1929). This paper is presented partially to make known the above mentioned records and partially to present certain experimental data resulting from artificial feeding experiments carried on during the Spring of 1933.

Appreciation is expressed to Prof. W. B. Herms who has been kind enough to furnish certain records from his personal experiences and correspondence, to Drs. David Goddard and Roderick Craig, who furnished information concerning the chemical composition of blood and plant juices, to Mr. Julius Freitag, who suggested the feeding apparatus used, and to Mr. John A. Elson, who has been interested in the food habits of Hemiptera for some time and added a good many interesting notes and records.

Among the published records on facultative blood sucking which have come to notice are Van Duzee's (1912) paper in which he states that *"Diaphnidia pellucida* Uhl. occurs most frequently on hickory trees and has a most annoying habit of biting sharply should it land where the skin is wet with perspiration. It seems to do this for sustenance and not for protection." Martini (1926) lists a number of species, normally phytophagous, which have been known to suck blood. The species which are additions to Meyers' list are as follows: *Chlamydatus associatus* Uhl., *Orthotylus flavosparsus* Sahlb., and *Haematocapsus bipunctatus*? . Reuter (1903) quotes from one of his earlier papers as follows: "It may be mentioned here that some of the Capsids known to be vegetable suckers feed, however, on animal juices also. Thus Professor Stal informed me that he was once stung by a *Phylus melanocephalus* Linn. and that the sting felt almost like that of a gnat."

Experiences which have been called to the attention of the author and cases which have been experienced by him are rather numerous. Prof. W. B. Herms reports a Membracid, *Ceresa bubalus* (Fabr.), in apple orchards in the Eastern United States as biting the backs of his hands. In the Cicadellidae records include the Sugar Beet Leafhopper, *Eutettix tenellus* (Bak.), which has frequently bitten Mr. Julius Freitag during life history and feeding experiments in the laboratory at the University of California. Likewise Mr. Calvert E. Norland and Mr. Gordon L. Smith found nymphs of the Grape Leafhopper, *Erythroneura comes* (Say), commonly biting their bare backs and the backs of

their hands when perspiring while working under grape vines near Fresno, California.

In the Heteroptera the author has experienced such bites so frequently that the phenomenon seems rather commonplace. While engaged in collecting with a sweeping net a host of Mirids or Cicadellids will sometimes burst out of the net from a single sweep. In such cases a few individuals will often attack one's bare, perspiring arms or neck. *Lopidea marginata* Uhler at Mokelumne Hill, Calveras Co., Calif., during 1931, was especially noted, the duration of the bite being more than one minute and the irritation considerable but of short duration. Another Mirid, *Irbisia solani* (Heid.), was incriminated at Russellman Park on the east slope of Mt. Diablo in April, 1933. Mr. E. G. Linsley was bitten on the arm. His arm was quite dry and the bite was of short duration leaving a small, red spot which soon disappeared.

In the family Coreidae Mr. John A. Elson succeeded in inducing the Box Elder Bug, *Leptocoris trivittatus* (Say), to feed for a considerable length of time on a piece of beef steak in the laboratory after first starving the bug for several days. This is even more striking than Misra's record (1924) of the normally predaceous Anthocorid, *Septicius clarus* Dist., which was found sucking meat in India. Mr. D. E. Howell induced specimens of *Leptocoris* to bite his arm after fasting them for five days.

The above observations on *Leptocoris trivittatus* (Say) and the relative abundance of this species led the author to choose it for experimental blood feeding in an attempt to determine whether the bugs could actually live on animal blood or not. Blood serum only, was fed to the bugs as it was found that the serum contained all of the essential compounds found in the blood as a whole and had the added feature of not coagulating due to the elimination of the haemoglobin. As a consequence it was not necessary to add any anticoagulin which might be toxic to the bugs. The type of feeder used was that developed by Severin (1931) and consisting of a small glass dish with perpendicular edges one and three-quarter inches in diameter and three-eights of an inch deep. After filling the glass feeder with blood serum an animal (Bandruche) membrane was stretched tightly across the surface and held taut by means of a rubber band. An ordinary drinking glass of an inside diameter equal to that of the outside diameter of the feeder was used as a cage with a net covering over the open end. In this the bugs were concentrated upon the surface of the membrane at the bottom of the glass. It was found that a one to two day period of starving was necessary before adults would feed. Nymphs which had just emerged from the egg fed within one day. When a new supply of serum was introduced the top of the membrane was often wet with a thin film of the serum and the bugs, under such conditions, appeared to touch their labia "eagerly" if momentarily to this liquid rather than piercing the membrane. The results of these experiments were disappointing in that no nymphs were raised through to maturity. However, the unnatural conditions of the feeder may have been largely responsible for this. Bugs were kept alive for periods of from four to fourteen days and nymphs, in some cases, successfully completed ecdysis and went into their second instar.

The author, although not disagreeing with Meyers' conclusions that the phenomenon under consideration is due to the stress or influence of unnatural

conditions such as light and the "host of stimuli—visual, tactile, thermal, olfactory —encountered upon alighting on a large vertebrate body", would like to stress two other factors at least one of which was ignored by Meyers. First, in the case of the occasional biting in the field the author's observations lead him to the conclusion that the attraction to exposed liquids plays an important part. This has been suggested by Bergevin (1925) who suggests that uric acid in perspiration is the compound which exerts the attraction. Surely perspiration plays an important part in a majority of the cases known to this author but since the *Leptocoris* nymphs were attracted to the exposed liquid blood serum, uric acid does not appear to be essential in this sort of attraction. Secondly, in the cases where starving was necessary the evidence seems to indicate that nourishment was the object of the bite. This was the case in the record, noted above, of *Leptocoris* biting the arm of D. E. Howell after being starved for five days. Also Van Duzee's record of 1912 appears to fall into this category and all of the author's feeding records are of this sort.

The change from the sucking of plant juices to bloodsucking at first appears to be very great. However, upon comparison of the chemical constituents, it is found that, in general, the same elements are found in plants as in blood and often in very similar combinations although in very different proportions. In plants we must distinguish between cytoplasm and cell sap for the purpose of analysis although the distinction must then be discarded as the insects undoubtedly get a mixture of both. Cytoplasm contains a high concentration of protein, lipoids and asparagine as well as starches, sucrose, and certain reducing sugars among the carbohydrates. Urea is probably absent as is ammonia. Cell sap, on the other hand, contains many free ions such as sodium, potassium, calcium, magnesium, chloride, etc., of which potassium is the dominant one. It also contains many organic acids such as tartaric, malic, citric, oxalic, etc., and fatty acids and no proteins and almost no ammonia and urea. Blood contains almost all of the sugars, proteins, salts, etc., found in plants but it is a great deal richer in nitrogenous materials as a whole and the type of protein is very different from that found in cytoplasm. Likewise the concentration, although differing greatly for cytoplasm and cell sap in the various species of plants and for blood in the various species of animals, is not so different as to prevent the use of one or the other to an insect not accustomed to both. Consequently we see that what is ordinarily considered to be a tremendous change, namely the jump from plant sucking to blood sucking, may be quite within the range of possibility.

It is interesting to note that insects other than Hemiptera which belong to well known phytophagous groups have ventured into this new field to a greater or less degree. Thus we have the very interesting records of Clarke (1925) in which he shows that some larvae of Lycaenidae range from cannibalism through to a clearly predaceous habit. He shows that in this family one finds cannibalism more prevalent than in the other Lepidopterous families. In the subfamily Lycaeninae he finds that the last larval stage of Lycaena orion Pall. devours the young of the ants which have been protecting it. From this there is a gradual transition to *Feniseca tarquinius* F. which feeds throughout its life on ant-tended Coccids. Then he tells of the two subfamilies Gerydinae and Liphyrinae in which

all of the species, in so far as is known, are carnivorous either on the young of ants or on ant-tended Aphidids, Coccids, Membracids, or Jassids.

In the Thysanoptera Miss B. B. Montgomery, in correspondence with Prof. W. B. Herms, writes that an invasion of thrips was noted at Columbus, Ohio. "Complaints have come from all over the city, especially north and east. The bites cause a sharp stinging prick. The skin around the bite burns for fifteen to thirty minutes afterward. A tiny red spot appears with no swelling and persists for several weeks." It is not known whether this species was normally predaceous or phytophagous.

In conclusion the author would state that the relatively rare phenomenon of blood sucking in the normally phytophagous groups of the Hemiptera may be attributed to three influences, namely, the stimulus of artificial light or other unusual conditions of the environment, the attractive qualities of exposed liquids, mainly perspiration, and hunger. It may also be concluded that this change is not such a profound one as would at first be supposed. This is evidenced by a comparison of the composition of plant juices and blood and by the various plant feeding groups some members of which have adapted themselves to a predaceous habit or have shown their ability to occasionally suck the blood of mammals. These conclusions may throw some light on the remarkable evolution of the Hemiptera into a diversity of food habits which is so complete as to include almost all available food material.

BIBLIOGRAPHY.

Bergevin, E. de, 1925, Les Hemipteres suceurs de sang. Arch. Inst. Pasteur Algerie, III, pp. 28-44, 9 figs.
Clarke, A. H., 1925, Carnivorous Butterflies. Annual Report, Smithsonian Inst., Wash., D. C., pp. 439-508.
Martini, E., 1926, in Schroder, C., Handbuch der Entomologie. Bd. II, Bog. 21-30, p. 382.
Meyers, J. G., 1929. Facultative Blood-Sucking in Phytophagous Hemiptera. Parasitology, XXI, 4, pp. 412-?80.
Misra, C. S., 1924, Observations on Some Rhynchota from Northern India. Rep. Proc. 5th Ent. Meeting, Pusa (1923), pp. 300 seqq. pls. 29, 30.
Reuter, O. M., 1903, On the Food of Capsidae. Ent. Month. Mag. XXXIX, p. 121.
Severin, H. H. P., 1931, Modes of Curly-top Transmission by the Beet Leafhopper, *Eutettix tenellus* (Baker). Hilgardia, VII, 8, p. 269.
Van Duzee, E. P., 1912, Hemipterological Gleanings, Bull. Buffalo Society Nat. Sci., X, pp. 477-512.

OBSERVATIONS ON THE BEHAVIOUR OF NEWLY HATCHED CODLING MOTH LARVAE.

BY J. ALLAN HALL,

Dominion Entomological Laboratory, Vineland Station, Ont.

The following notes are based on observations of young larvae from the time of hatching until they became established within the apples or were lost or dried.

Pre-establishment Period:—The period of wandering without feeding of 46 larvae on leaves and fruit (time from transfer until entries were started in the fruit) varied from 15 to 330 minutes and averaged 84 minutes. Two larvae were observed to establish themselves in the fruit after spending 48 hours on the leaves, during which time they did a small amount of feeding on the tissues of the leaves.

Rate of Travel:—On apples, leaves and twigs, and when temperatures ranged from 60° to 70° F. the timed rate of travel averaged approximately one

inch per minute. On sprayed material this rate was reduced to about one-half inch per minute. The rate of movement gradually decreased at temperatures below 60° until at 50° F. there was practically no activity.

Direction of Travel:—The larvae wander in a haphazard, zigzag or circling manner, frequently travelling several times over the same lines in the same or opposite directions, *e. g.* one larva on a three-inch apple travelled 12¾ inches in 15 minutes and was never, during this period, more than two inches from its starting point. They travel away from very bright sunlight seeking the shaded side. When hatched on or transferred to the upper side of the leaves they rapidly make their way to the underside. Larvae were observed to avoid carefully tanglefoot bands but were undeterred by the presence of spray residue (lead arsenate).

Ability to Subsist on Leaves:—Larvae under observation lived for periods up to 30 days on a purely leaf diet but none survived to maturity. Caterpillars existing on leaves for periods from time of hatching up to seven days, (tests were not made for longer periods) were capable of establishing themselves in the fruit. The mortality of larvae on a leaf diet is quite high—in our experiments only two out of a total of 60 larvae were found alive at the end of the seventh day. Incidentally on sprayed leaves (arsenate of lead, 2 lbs. to 40 gals.) all succumbed within 20 hours.

Place of Feeding on the Leaves:—In all the instances observed the feeding took place on or close to the larger veins and always on the undersides of the leaves.

Ability to Find Fruit:—Our observations afford no evidence that the larvae are capable of locating the fruit except by chance. In numerous cases individuals travelling over twigs and leaves in contact with apples, were observed to pass within one-quarter to one-eighth inch of these fruits and yet fail to find them. A few wandered from the fruit to the leaves and failed to find their way back. Eighty-five larvae were placed on leaves at distances of 2 to 12 inches from apples and only 37 or 43.5 per cent found their way to the fruit.

Ability to Enter Fruit:—The ability of newly hatched larvae to enter apples is largely governed by temperature. No larvae enter at temperatures below 50° F. but above this the number entering increases directly with a rise of temperature until the optimum is reached. Other factors on which we have insufficient data, are (1) varietal resistance, which is probably determined by the physical condition of the surface of the fruit, and (2) the condition of the fruit as brought about by the nature of the growing season and the soil. That the condition of the fruit is a factor is evidenced by some of our experiments which show that picked apples are more easily entered than apples on the tree. The table below gives the numbers of larvae entering Baldwin apples under average summer conditions both in the orchard and the laboratory. Similar results were obtained in the laboratory with Stark apples.

LARVAE SUCCESSFULLY ENTERING BALDWIN APPLES.

Place	Treatment	No. of Larvae	No. Entered	% Entered
Laboratory	none	2543	2090	82.20
Orchard	none	100	42	42.00
Laboratory	lead arsenate*	1460	62	4.25
Orchard	lead arsenate	100	3	3.00

*2 lbs. in 40 gallons.

Place of Entry Into Fruit:—An experiment in which 183 larvae entered one large apple via separate entrances indicates that it is possible for them to enter at any point on the surface of the fruit. During the period 1923 to 1928, inclusive, 13,289 first generation and 25,058 second generation larval entries on unsprayed apples were examined. The figures as given in the report of the Entomological Society of Ontario, 1928, page 105, show that 57% of first generation, 82% of second generation, and 73% of the total entries were made in the side of the apple, and 43%, 18% and 27% respectively were calyx entries.

In laboratory experiments fully 75% of the larvae entered in the area of the fruit exposed to the direct light, and observations indicate that 60% to 70% behave similarly in the orchard on unsprayed fruit.

Method of Entry:—After choosing a place to enter the apple the larva spins a few strands of silk on the surface of the apple to ensure its footing and then begins its excavations. The mandibles are forced into the apple tissues by a downward and forward thrust and side to side motion of the head and neck. The piece between the mandibles is broken loose by a short backward jerk of the body and a sidewise twist of the head. All of the first particles removed are cast aside and only rarely is any material ingested before the pulp of the apple is reached.

Time Required for Entry:—The period elapsing between the starting of an entry and the time at which the larva is in and covered varied from 15 to 200 minutes and averaged 70.8 minutes for the 25 larvae timed. This period varies a good deal with the temperature and the physical condition of the apple being entered.

THE AMERICAN SPECIES OF DALOPIUS ESCH. (ELATERIDAE, COLEOP.)*

BY W. J. BROWN,

Ottawa, Ontario.

(continued from page 96)

28 **Dalopius validus** n. sp.

Male. Length 8 mm. Black; the antennae, anterior margin and posterior angles of pronotum, and elytra very dark reddish-brown, almost black; legs reddish-brown.

Antenna surpassing the pronotal angle by the length of two segments, the fourth segment four-fifths as long as the second and third united. Pronotum as long as wide, its posterior angles feebly produced, the disk slightly more densely punctate than in *incomptus*. Propleuron feebly emarginate, not angulate. Elytron truncate at apex.

Length of aedeagus 1.15 mm.; the lateral lobes stout, their apical portions not angulate.

Holotype—♂, Sequoia National Park, Calif., 7000-9000 ft., June 13, 1929, (A. T. McClay); No. 3570 in the Canadian National Collection, Ottawa.

Paratypes—1 ♂, same data; 1 ♂, Nr. Mather, Toulomne Co., Calif., July 13, 1929, (E. C. Zimmerman).

The paratypes measure 7.5 and 7.8 mm. and do not vary in color. The species occurs in the same locality as *incomptus* and can be separated from the latter only by the characters of the aedeagus and the sculpture of the pronotum. To this species, I refer a female from Toulomne County.

29. **Dalopius spretus** n. sp.

Male. Length 7.5 mm. Body slightly more elongate than usual. Very dark brown; the anterior margin and posterior angles of the prothorax red; the legs reddish-brown.

Antenna surpassing the pronotal angle by the length of two and one-third segments, the fourth segment seven-tenths as long as the second and third united. Pronotal width equal to nine-tenths the length, the posterior angles rather feebly produced. Propleuron feebly emarginate, not angulate. Elytron truncate at apex.

Length of aedeagus 1.02 mm.; median lobe not carinate; median struts parallel, strongly angulate.

Holotype—♂, Agassiz, B. C., May 6, 1927, (H. H. Ross); No. 3571 in the Canadian National Collection, Ottawa.

Paratypes—2 ♂, same data; 1 ♂, same data, April 26, 1927; 1 ♂, same locality, June 9, 1926, (R. Glendenning); 1 ♂, Cheam Mts., B. C., 1905, (J. M. Macoun); 1 ♂, Oyama, B. C., June 6, 1926, (R. Hopping); 1 ♂, Bend, B. C., Aug. 9, 1932, (G. Stace Smith).

The paratypes measure from 7.2 to 8.2 mm. In two, the elytra are reddish-brown. The aedeagus measures from .94 to 1.02 mm. In three of the specimens, the inner ventral margins of the lateral lobes are not visible in the dorsal aspect as in the holotype. The aedeagus differs from that of *vetulus* in the form of the apices of the lateral lobes. On account of its large size and blackish color, *spretus* does not resemble closely the species with which it is associated by the characters of the aedeagus. It does resemble *insulanus* and *maritimus,* in which the antennae are longer, and *tristis.*

30. **Dalopius vetulus** n. sp.

Male. Length 7.2 mm. Dorsum very dark brown, the anterior margin and posterior angles of the prothorax and legs reddish-brown; venter blackish.

Antenna surpassing the pronotal angle by the length of two and one-half segments, the fourth segment three-fourths as long as the second and third united. Pronotum as wide as long, its posterior angles moderately produced. Propleuron feebly emarginate, not angulate. Elytron truncate at apex.

Length of aedeagus .97 mm.; its form as in *spretus* but with the apical portions of the lateral lobes shorter.

Holotype—♂. Woodacre, Calif., April 19, 1930, (A. T. McClay); No. 3572 in the Canadian National Collection, Ottawa.

Paratype—♂, Willits, Calif., May 24, 1930, (R. Hopping).

The paratype measures 6.9 mm. and has the dorsum paler in color. The elytra are pale reddish-brown, and the sides of the prothorax are rather broadly-

reddish-yellow. The species is closely allied to *spretus* but is smaller and has the apical portions of the lateral lobes of a different form.

31. **Dalopius partitus** n. sp.

Male. Length 7.2 mm. Pale reddish-yellow; the head and antennae reddish-brown; a median pronotal spot, elytral vitta, metasternum, and abdomen pale reddish brown; the pronotal spot elongate, attaining the basal but not apical margin, occupying about one-fifth the area of the disk; the elytral vitta sutural, extending over basal three-fifths, and occupying three intervals on each elytron.

Antenna surpassing the pronotal angle by the length of three segments, the fourth segment four-fifths as long as the second and third united. Pronotum as wide as long, its posterior angles rather feebly produced. Propleuron feebly emarginate, not angulate. Elytron truncate at apex.

Length of aedeagus 1.06 mm.; the median lobe not carinate; the apical portions of the lateral lobes very small.

Holotype—♂, Havilah, Kern Co., Calif., May 20, 1913, (R. Hopping); No. 3573 in the Canadian National Collection, Ottawa.

It will be found probably that most specimens are not as pale as the type. The species resembles *gracilis* in color.

32. **Dalopius effetus** n. sp.

Male. Length 6.7 mm. Head, venter, and a median area on the pronotum attaining the basal but not the apical margin and occupying about half the disk black; antennae, prothoracic margins, elytra, and legs pale reddish-brown.

Antenna surpassing the pronotal angle by the length of two and one-half segments, the fourth segment four-fifths as long as the second and third united. Pronotum as wide as long, the posterior angles rather feebly produced. Propleuron feebly emarginate, not angulate. Elytron truncate at apex.

Length of aedeagus .99 mm.; the median lobe not carinate, its apex narrow; inner margins of lateral lobes straight near the base.

Holotype—♂, Fallen Leaf Lake, Tahoe, Calif., June 29, 1915; No. 3574 in the Canadian National Collection, Ottawa.

The species resembles a number of others in color.

33. **Dalopius suspectus** n. sp.

Male. Length 6.5 mm. Black; the elytra, anterior margin and posterior angles of the pronotum, and basal segments of antennae reddish-yellow; the legs pale reddish-brown; each elytron with a black sutural vitta extending over two intervals and the basal declivity.

Antenna surpassing the pronotal angle by the length of two and one-half segments, the fourth segment four-fifths as long as the second and third united. Pronotum as wide as long, its posterior angles rather feebly produced. Propleuron feebly emarginate, not angulate. Elytron subtruncate.

Length of aedeagus 1.12 mm.; the median lobe not carinate, the lobes subparallel.

Holotype—♂, Hope Trail, B. C., June 2, 1930, (G. Stace Smith); No. 3575 in the Canadian National Collection, Ottawa.

Paratypes—1 ♂, Hope Mountains, B. C., July 25, 1932, (A. N. Gartrell); 1 ♂, Copper Mountain, B. C., May 15, 1930, (G. Stace Smith); 1 ♂, Enderby,

B. C., April 20, 1921; 1 ♂, Emerald Mine, B. C., July 1-15, 1928, (H. C. Hughes); 2 ♂, Vancouver, B. C., July 2 and 6, 1930, (H. Leech).

The paratypes measure from 5.8 to 6.5 mm. In three of them, the sides of the pronotum are narrowly reddish-yellow. In two specimens, only the basal declivity of the elytra is black; in two others, the black vitta does not attain the apex; and in one, the vitta is slightly wider than in the holotype. The aedeagus measures from 1.15 to 1.22 mm. and shows much more variation than is usual. In several, the lateral lobes are more slender than in the holotype, and in one, the apical portions of the lateral lobes are more elongate. The species may be known only by the characters of the aedeagus. It resembles *asellus* and *fucatus* in color.

34. **Dalopius fucatus** n. sp.

Male. Length 6.2 mm. Black; the elytra, anterior margin and posterior angles of prothorax, and legs pale reddish-brown; each elytron with a sutural black vitta; the vitta occupying the sutural interval in apical half, widened to the base and there occupying the area within the umbone.

Antenna surpassing the pronotal angle by the length of two and one-quarter segments, the fourth segment seven-tenths as long as the second and third united. Pronotum as wide as long, its posterior angles rather feebly produced. Propleuron feebly emarginate, not angulate. Elytron subtruncate at apex.

Length of aedeagus .94 mm.; median lobe carinate; the form of the aedeagus much as in *tristis*, but the lobes less elongate, the median lobe relatively wider at the apex, the inner margins of the lateral lobes straighter near the base.

Female. Antenna surpassing the pronotal angle by the length of one segment.

Holotype—♂, Crow's Nest Pass, Alta., June 6, 1930, (J. H. Pepper); No. 3576 in the Canadian National Collection, Ottawa.

Allotype—♀, same data, June 9, 1930.

Paratypes—8 ♂, 5 ♀, same data, June 6, 7, and 9, 1930; 1 ♂, Medicine Hat, Alta., June 15, 1930, (J. H. Pepper); 5 ♂, Copper Mountain, B. C., May 4 to 16, 1930, (G. Stace Smith); 1 ♂, Vernon, B. C., May 24, 1918, (W. Downes); 1 ♂, Voght Valley, B. C., May, 1921, (R. Hopping); 2 ♂, Aspen Grove, B. C., May 22 and June 4, 1931, (H. Richmond and J. R. Howell); 1 ♂, Williams Lake, B. C., May 14, 1929, (R. Hopping).

The paratypes measure from 5.6 to 6.6 mm. The elytra and legs vary from reddish-brown to reddish-yellow. The black vitta is sometimes indistinct in the apical half and may be expanded to occupy three intervals on each elytron. In four dark specimens, the vittae are obscure, and the elytra are reddish-brown throughout. In one specimen, the sides of the pronotum are narrowly red. The aedeagus measures from .88 to 1.01 mm. The species is closely allied to *tristis* but is usually paler and smaller than the latter. It can be distinguished from *suspectus* only by the characters of the aedeagus. It resembles *asellus* in color also, but the latter is usually smaller.

35. **Dalopius tristis** n. sp.

Male. Length 7.6 mm. Black; elytra and legs very dark reddish-brown; the elytral umbones and apical margin and posterior angles of the prothorax red.

Antenna surpassing the pronotal angle by the length of two segments,

the fourth segment three-fourths as long as the second and third united. Pronotum as long as wide, its posterior angles moderately produced. Propleuron feebly emarginate, not angulate. Elytron distinctly truncate at apex.

Length of aedeagus 1.01 mm.; form much as in *fucatus*, but the median lobe narrowed nearer the apex and its apical portion relatively narrower.

Female. Color pale; the entire lateral margin of the prothorax reddish-brown; elytron reddish-brown with a black subscutellar area which extends along the first and second intervals to form a black vitta, this vitta poorly limited and not at all conspicuous. Antenna surpassing the pronotal angle by the length of one segment.

Holotype—♂, Creston, B. C., May 8, 1928, (G. Stace Smith); No. 3577 in the Canadian National Collection, Ottawa.

Allotype—♀, same data, May 7, 1928.

Paratypes—24 ♂, 32 ♀, same data, April 9 to May 29, 1928 to 1931; 1 ♂, 1 ♀, same data, May 28, 1926, (A. A. Dennys); 1 ♂, Fish Lake, Summerland, B. C., June 24, 1931, (A. N. Gartrell); 1 ♂, Hope Trail, B. C., July 4, 1930, (G. Stace Smith); 1 ♂, North Vancouver, B. C., May 23, 1913, (A. Gibson); 1 ♂, Vancouver, B. C., June 1, 1924, (F. Perry); 2 ♂, 1 ♀, Stanley Park, Vancouver, B. C., April 11, 1915, (Chrystal); 2 ♂, 1 ♀, Stanley, B. C., July 22 and 28, 1931, (K. Graham); 1 ♂, Shawnigan, B. C., June 11, 1921, (W. Downes); 1 ♂, Duncan, B. C., July 4, 1911; 1 ♂, Likeley, B. C., May 18, 1929, (W. Mathers); 1 ♂, Nelson, B. C., May 18, 1926, (A. A. Dennys); 1 ♂, BX Mt., Vernon, B. C., June 2, 1931, (R. Hopping); 20 ♂, 4 ♀, Vernon, B. C., April 27 to June 11, 1920 to 1931, (R. Hopping, W. Downes, E. A. Rendell); 3 ♂, 2 ♂, Enderby, B. C., April 20 and June 2, 1921; 3 ♂, 4 ♀, Saanich, B. C., April 22 and 28, 1930, May 17 and June 28, 1929, June 3, 1913, Sept. 19, 1924, (W. Downes, W. H. A. Preece); 3 ♂, 2 ♀, Peachland, B. C., May 26, 1918 and Aug. 7, 1909, (W. R. S. Metcalfe and J. B. Wallis); 5 ♂, 5 ♀, Pender Harbor, B. C., April 6 to June 18, 1926 to 1928, (G. R. Hopping); 3 ♂, Otter Creek, B. C., June 14, 1920, (Hopping); 1 ♂, Mara, B. C., April 10, 1921, (H. Blurton); 14 ♂, 51 ♀, Trinity Valley, B. C., April 17 to Aug. 24, 1927 to 1930, (J. R. L. Howell, H. Richmond, E. A. Rendell, R. T. Turner); 1 ♂, Creighton Valley, Lumby, B. C., May 6, 1923, (R. Hopping); 3 ♂, Midday Valley, Merritt, B. C., May 12, 1925, and May 18 and June 2, 1926, (J. Stanley, E. Rendell, W. Mathers).

The paratypes measure from 5.9 to 8 mm. The males vary little in color. In a few, there is a poorly limited pale vitta extending posteriorly on the elytron from the humeral umbone. Rarely this vitta is expanded until the elytron resembles that of the allotype. In only three of the males are the lateral margins of the prothorax pale. In the females, this pale margin is usually quite narrow, but only rarely is it lacking. The elytra vary to reddish-yellow. The lateral margin of the elytron as well as the sutural, is frequently black, and the pale area of the middle is sometimes contracted until the elytron resembles that of a pale male. Very rarely the female is as dark as the male; usually the sexes may be distinguished without difficulty by the color. This is the only species in which I have noted sexual differences in the color. The aedeagus measures from 9.02 to 1.06 mm. The inner margin of the lateral lobe is often straighter near the base than in the type but is never as straight as in *fucatus*. All the lobes are

less elongate in the allied species, and the differences in the median lobe are quite constant.

It is difficult to recognize *tristis* with certainty except by the characters of the aedeagus. Large males resemble *spretus,* and small pale males resemble *fucatus.* The color characters will always distinguish *gartrelli.*

36. **Dalopius manipularis** n. sp.

Male. Length 6.7 mm. Black; antennae, legs, and elytra reddish-brown; anterior margin and posterior angles of prothorax and a poorly delimited vitta on each elytron reddish-yellow; the vitta extending from the humeral umbone to the middle and from the third stria almost to the lateral margin.

Antenna surpassing the pronotal angle by the length of three segments, the fourth segment three-fourths as long as the second and third united. Pronotum as long as wide, the posterior angles rather feebly produced. Propleuron feebly emarginate, not angulate. Elytron truncate at apex.

Length of aedeagus 1.05 mm.; the median lobe carinate, less strongly constricted than in *ignobilis.*

Holotype—♂, Round Mdw., Giant Forest, Calif., 6400 ft., July, 1915, (Hopping); No. 3578 in the Canadian National Collection, Ottawa.

Paratype—1 ♂, same data.

The paratype measures 7.2 mm. and has the elytra paler, the pale vitta being expanded to cover all of each elytron except the basal declivity, sutural interval and apical fifth. The species resembles some forms of *tularensis* in color.

37. **Dalopius ignobilis** n. sp.

Male. Length 7 mm. Head, prothorax except the margins, metasternum, and abdomen except the apex black; antennae dark brown, the basal segments pale; prothoracic margins narrowly, elytra, and legs pale brownish-red, the basal declivity of the elytra dark brown.

Antenna surpassing the pronotal angle by the length of three and one-third segments, the fourth segment seven-tenths as long as the second and third united. Pronotum as wide as long, its posterior angles rather feebly produced. Propleuron feebly emarginate, not angulate. Elytron subtruncate at apex.

Length of aedeagus 1.10 mm.; the median lobe carinate, strongly constricted; the lateral lobes parallel, the angle formed at their bases much larger than in any other species.

Female. Antenna surpassing the pronotal angle by the length of one and one-half segments.

Holotype—♂, Fallen Leaf Lake, Lake Tahoe, Calif., June 28, 1930, (A. T. McClay); No. 3579 in the Canadian National Collection, Ottawa.

Allotype—♀, same data, June 20, 1930.

Paratypes—3 ♂, 5 ♀, same data, June 12 to 28, 1930; 1 ♂, 1 ♀, G. Alpine Sp., Tahoe, Calif., June 19, 1930; 1 ♂, Tahoe, Calif., July 7, 1915, (R. Hopping).

The paratypes measure from 6.6 to 7.5 mm. In several specimens, the pale margins of the prothorax are wide, and the pronotal disk and antennae are sometimes reddish-brown. The elytra vary to reddish-yellow, and the basal black spot may extend a short distance behind the scutellum or may be entirely

absent. The aedeagus measures from 1.04 to 1.17 mm. In color, the species resembles *plutonicus* and *dentatus*.

38. **Dalopius improvidus** n. sp.

Male. Length 6.5 mm. Entire body rather pale reddish-brown; the legs reddish-yellow.

Antenna surpassing the pronotal angle by the length of two and one-third segments, the fourth segment three-fourths as long as the second and third united. Pronotum as wide as long, its posterior angles moderately produced. Propleuron feebly emarginate, not angulate. Elytron truncate at apex.

Length of aedeagus 1.02 mm.; the median lobe strongly constricted, without a median carina but with two carinae on the dorsal face before the constriction and two on the ventral face at the constriction as figured.

Holotype— ♂, Camp Greely, Fresno Co., Calif., 2800 ft., Sept. 15, 1908, (R. Hopping); No. 3580 in the Canadian National Collection, Ottawa.

Paratype— ♂, Whitehall, Calif., July, 1932, (L. W. Saylor).

The paratype measures 5.5 mm., its aedeagus .97 mm. The species resembles somewhat *vetulus* and *effetus* in color; it is darker than *luteolus* and paler than the eastern *insolitus*.

39. **Dalopius insulanus** n. sp.

Male. Length 7.8 mm. Body more elongate than usual. Black, the angles of the prothorax not paler, the legs and antennae very dark brown.

Antenna surpassing the pronotal angle by the length of three segments, the fourth segment four-fifths as long as the second and third united. Pronotal width equal to nine-tenths the length, the posterior angles feebly produced. Propleuron feebly emarginate, feebly subangulate. Elytron very distinctly truncate at apex.

Length of aedeagus 1.73 mm.; the form as in *invidiosus*.

Holotype— ♂, Stanley Park, Vancouver, B. C., April 11, 1915, (Chrystal); No. 3581 in the Canadian National Collection, Ottawa.

Paratypes—2 ♂, same data; 3 ♂, same data, 1915; 3 ♂, Vancouver, B. C., March 20, 1920, May 23, 1930, July 19, 1931, (W. B. Anderson, H. B. Leech); 2 ♂, North Vancouver, B. C., April 10, 1921, (W. B. Anderson); 2 ♂, Point Grey, Vancouver, B. C., Sept. 21 and Nov. 12, 1927, (G. R. Hopping); 1 ♂, Saanich Dist., B. C., Sept. 19, 1924, (W. Downes).

The paratypes measure from 7 to 7.9 mm. In one specimen, the elytra are reddish-brown, and in another each humeral umbone bears an elongate yellow spot. In none are the angles of the prothorax paler than the disk. The species resembles *spretus, tristis,* and *maritimus* on account of its size and color, and can be distinguished from these with certainty only by the characters of the aedeagus. On account of their immaculate elytra, I refer two females from Stanley Park and Vancouver to this species. In the allied *maritimus*, the humeral umbone of the elytron is always pale.

The aedeagus measures from 1.61 to 1.84 and differs constantly in form from the aedeagus of *maritimus* and of *mutabilis*. In the present species, the lobes are more elongate, the median lobe is less rounded and more pointed at the apex, and the oblique apical margins of the lateral lobes are straighter and less sinuous than in those allied species. I cannot separate *insulanus* and *invidiosus* by the

characters of the aedeagus, but the latter is constantly smaller and pale in color.

40. **Dalopius invidiosus** n. sp.

Male. Length 6.9 mm. Body elongate. Dorsum reddish-yellow; the base of the head, a pronotal spot, and elytral markings black; venter and antennae black; the legs very dark reddish-brown; the pronotal spot not quite attaining the basal and apical margins, occupying about half of the pronotal area; each elytron with the basal declivity and the lateral and sutural margins black, the lateral vitta very narrow and confined to the apical half; the sutural vitta widest in apical half where it occupies three intervals.

Antenna surpassing the pronotal angle by the length of three segments, the fourth segment nine-tenths as long as the second and third united. Pronotal width equal to nine-tenths the length, the posterior angles rather feebly produced. Propleuron feebly emarginate, not angulate. Elytron very distinctly truncate at apex.

Length of aedeagus 1.64 mm.; the form as in *insulanus*.

Holotype—♂, Mt. Hamilton, Calif., June 3, 1932, (L. W. Saylor); No. 3582 in the Canadian National Collection, Ottawa.

Paratypes—3♂, same data; 1♂, San Francisco, Calif., 1914, (R. F. Sternitzky).

The paratypes measure from 6.8 to 7 mm. In one the central black spot is reduced to occupy about one-fourth of the pronotal area. The aedeagus measures from 1.62 to 1.75 mm. The species is smaller and paler in color than *insulanus* but does not differ from the latter in the characters of the aedeagus. It bears the same relationship to *insulanus* that *mutabilis* bears to *maritimus*. On account of its pale color, it resembles *gracilis* very closely.

41. **Dalopius maritimus** n. sp.

Male. Length 7 mm. Body more elongate than usual. Blackish, the prothoracic angles and legs scarcely paler; humeral umbone of each elytron with an elongate, reddish-yellow spot.

Antenna surpassing the pronotal angle by the length of three segments, the fourth segment nine-tenths as long as the second and third united. Pronotal width equal to nine-tenths the length, the posterior angles feebly produced. Propleuron feebly emarginate, subangulate. Elytron very distinctly truncate at apex.

Length of aedeagus 1.45 mm.; the form as in *mutabilis*.

Holotype—♂, Departure Bay, B. C., July 3-11, 1925; No. 3583 in the Canadian National Collection, Ottawa.

Paratypes—4♂, same data; 2♂, Stanley Park, Vancouver, B. C., April 11, 1915, (Chrystal); 1♂, Agassiz, B. C., May 5, 1927, (H. H. Ross).

The paratypes measure from 6.7 to 7.8 mm. The color varies from very dark brown to black. The prothoracic angles may or may not be paler than the disk. The humeral spot is distinct in all specimens and may extend as far as the mdidle of the elytron. In a single female, labeled like the holotype, which I refer to this species, the sides of the prothorax are reddish-brown. Three other females are normal in color. Like *insulanus*, the present species resembles several of the large, dark species of British Columbia. The aedeagus measures from 1.41 to 1.77 mm. and is similar to that of *mutabilis*. In the latter, the lateral

lobes are usually a trifle stouter than in *maritimus,* but the species can be distinguished with certainty only by the color of the elytra.

42. **Dalopius mutabilis** n. sp.

Male. Length 7.5 mm. Body more elongate than usual. Blackish; the anterior margin and posterior angles of prothorax red; the antennae and legs very dark brown; each elytron with a reddish-yellow vitta; the vitta occupying five intervals near the base, narrower in apical half, extending from the humeral umbone almost to apex.

Antenna surpassing the pronotal angle by the length of three and one-half segments, the fourth segment equal in length to the second and third united. Pronotal width equal to nine-tenths the length, the posterior angles moderately produced. Propleuron feebly emarginate, not angulate. Elytron very distinctly truncate at apex.

Length of aedeagus 1.56 mm.; the form as in *maritimus.*

Female. Antenna surpassing the pronotal angle by the length of one and one-third segments.

Holotype—♂, Inverness, Calif., March 20, 1926; No. 3584 in the Canadian National Collection, Ottawa.

Allotype—♀, same data.

Paratypes—1 ♂, same data; 2 ♂, Ben Lomond, Calif., May 25, 1932, (L. W. Saylor); 1 ♂, Angora Lake, Tahoe, Calif., June 22, 1915.

The paratypes measure from 7.8 to 8.5 mm. The Inverness paratype is entirely blackish, resembling *insulanus* in color. In the Tahoe specimen, the prothorax is largely red. The aedeagus measures from 1.25 to 1.68 mm. and differs from that of *maritimus* only in having the lateral lobes a trifle stouter. The two species cannot be separated by the characters of the aedeagus. The posterior angles of the prothorax are very slightly but distinctly more elongate in *mutabilis* than in *martitimus.* The black Inverness paratype noted above demonstrates that the color difference is not constant; however, it is probable that color may be relied upon usually for distinguishing these species.

ACARIASIS OF THE WHITE RAT (RATTUS NORVEGICUS FORM ALBINUS)*

BY LOUIS V. SKIDMORE,
University of Nebraska, Lincoln, Nebraska.

INTRODUCTION.

In August 1929 the writer examined a colony of white rats which were being used in a nutrition experiment. These rats were scratching themselves about the head, nose and neck. Many had small dry scabs on the head, about the ears, and upper sides of the neck.. Some had bloody scabs due to bleeding caused by severe scratching. Parasitic infestation was suspected and microscopic examination showed the presence of mites.

Skin scrapings from these rats were sent to Dr. H. E. Ewing, Associate Entomologist, Bureau of Entomology, Washington, D.C. Dr. Ewing replied October 15, 1929, stating he found mites, in these skin scrapings, which belonged

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to the genus *Myobia*. Further information received from Dr. Ewing, January 11, 1930, was as follows: "I have studied again the mites which you sent from skin scrapings taken from white rats but I cannot place this species. It is not at all like *Myobia musculi*, found on the house mouse. It is very near *Myobia* sp. figured by Hirst, 'Mites Injurious to Domestic Animals' (1922) British Museum, Economic Series, No. 13, p. 55. Hirst does not give the host of his Myobia sp." The writer examined this reference and found that Hirst does show a fig. 39(b) of *Myobia* sp. apparently the same as the one under discussion here. Hirst, in his "Studies on Acari" (1919) shows plate XIII, figure 52, a Cheletid Mite, *Myobia* species, but again the host is not mentioned. The figure is the same in both references. Hirst mentions that: "It is possible that the mites of the family *Demodicidae* were originally pilicolous mites like *Myobia*, etc."

The description of *Myobia musculi* as given by Edouard Claparede (1868) in his "Studien an Acariden" is not in entire agreement with the description of the mite described in this paper.

Megnin (1878) describes *Myobia musculi* (Claparede). My study of the mite found on the rats in the colony under observation agrees with his description except that his measurements of the length of the male 380 u and of the female 450 u are greater than those found by the writer.

Megnin (1878) (1892) in his description of the genus *Myobia* (Heyden) says that the second pair of legs terminate in two claws while the two posterior legs terminate in a single claw.

Osborn (1896) has reported the finding of *Myobia musculi* many times on mice at Ames, Iowa, and has also received specimens from Professor Bruner of the University of Nebraska.

Oudemans (1907) gives a "Revision des Cheletines."

According to Goodall (1913); "*Myobia* may be found on all small mammals—moles, rats, voles, shrews and mice, though the rat is probably their special host. They differ somewhat, both in size and detail, according to the host on which they are found. The very curious corkscrew-like twist of the first pair of legs by which they cling onto the hair of their host is well worth close examination."

Banks (1915) states that; "the genus *Myobia* was based on a species from the head of the house mouse." His fig. 32, *Myobia canadensis* is not like the *Myobia* described in this paper.

Ewing (1929) in his book, "A Manual of External Parasites," page 30. describes the genus *Myobia* (Heyden) as follows: "In Myobia the anterior pair of legs become modified into hair-clasping apparatus. They are very short and stout and each terminates in a large clawlike structure. The other legs are similar, subequal and one-clawed. Although the adults are pilicolous, the nymph infest the hair follicles. Here they feed on the oily secretions and here they transform into adults. The eggs are laid attached to the hair of the host. *Myobia* species are found on many small mammals, but particularly on mice and bats."

Dr. A. E. Benbrook of the Iowa State College, Ames, Iowa, on December 20, 1930, sent the writer some photomicrographs of mites he had found on white rats. These mites are apparently the same as described in this paper.

Greenman and Duhring (1931) state that the mites most commonly found on white rats are *Laelaps echidninus* Berlese, and *Notoedres muris* Megnin.

DESCRIPTION OF MITE STUDIED.

Adult. The adults are pilicolous. The body is yellowish in color, elongated, oval shaped, unsegmented and transversely striated. A few sharp pointed setae are symmetrically arranged on the dorsal surface of the body. There are also a few setae on the legs. A lobe extends laterally from the body between each pair of legs. No division can be seen between the cephalothorax and abdomen. The anterior pair of legs are short, composed of three segments, modified into large claw-like structures for hair clasping. The other legs are composed of five segments. The second pair of legs terminate in two claws, the third and fourth pairs terminate in one claw. The claws are longer on the third and fourth pairs of legs. The tracheal system is well developed and the lateral branches unite in a median trunk located 75 u from the anterior end of the palpi. The single pair of terminal setae are much farther apart in the female than in the male.

Females. The female measures 300 u to 326 u in length and 187.50 u to 195 u in width and are more oval in shape than the males. The symmetrical shaped ovaries are located on each side of the center of the body opposite the third pair of legs. The vulva is slightly ventral and nearly marginal. The anus is located ventrally between the terminal setae. The single pair of terminal setae measure 131.25 u to 318.75 u in length and are 60 u to 71.25 u apart at the posterior end of the abdomen where they attach to the body.

Males. The males measure 262.50 u to 292.50 u in length and 150 u to 168.75 u in width. The average size was 288.56 u long by 154 u wide. The penis is a slender, slightly curved, elongated structure located on the dorsal side of the body, contained in a special internal body pouch and emerges between the second and third pair of legs. It is directed forward and upward and measures 90 u to 93.75 u in length (see figure). The single pair of terminal setae are 315 u to 348.75 u in length, average 325.51 u, and are 7.5 u apart at the posteroir end of the abdomen. The anus is located ventrally between terminal setae where they attach to the body.

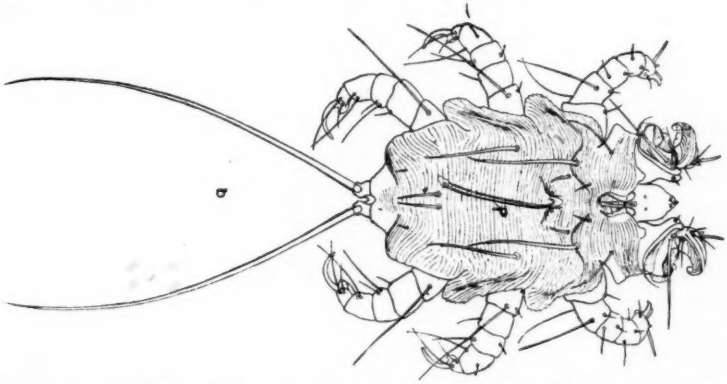
Note. Male mites *Myobia musculi* (Claparede) (1868) collected locally by the writer from the common mouse measured 243.75 u to 258.75 u in length and 138.75 u to 150 u in width. The longest setae found in any of the male mites examined were 262.50 u.

Nymphs. The nymphs have eight legs. They measure 221.50 u to 326.25 u in length and 145 u to 225 u in width. The average size was 276.60 u long by 181.61 u wide. The terminal setae measure 145 u to 270 u in length, and the average length was 233 u. The special sheath enclosing the mandibles measures 86.25 u to 93.75 u in length and 7.5 u in width. In the nymph stage the tracheal system may be plainly seen in specimens mounted in glycerine jelly. The genital organs are not developed. The sex, however, can be determined by the distance between the two terminal setae. (Writer's observation.)

Larvae. The larvae have six legs. They measure 202 u to 225 u in length and 127.50 u to 150 u in width. They are distinguished from the nymphs by the absence of the fourth pair of legs. The single pair of styliform mandibles

enclosed in a conical sucker are found in both the larval and the nymph stage.

Eggs. The eggs are ellipsoidal in shape, attached singly to the hair, usually 480 u to 576 u from the end of hair root. The upper end of the egg is founded and free, while the lower end is securely fastened to the hair for a distance of from 37.50 u to 52.50 u. The eggs measure 168.75 u to 202.50 u in length and 60 u to 97.50 u in width. The average length was 186.25 u and the average width 81.25 u. The head of the larva in the egg is directed toward the free end of the hair. The larvae develop six legs in the egg, the posterior or fourth pair of legs are not developed. The styliform mandibles are enclosed in a special conical sucker which is retractile. In one egg a larva was observed with two terminal setae well developed and curled under the ventral surface of the body. Another larva in an egg measured 120 u in length and 45 u in width. Its conical sucker protruded 52.50 u in length beyond the opened end of the egg. A pair of styliform mandibles were enclosed within the conical sucker.



Myobia sp., a pilicolous mite, dorsal view of male (after Hirst, Studies on Acari, No. 1). P=penis.

Note. Eggs collected locally from the common brown rat (*Rattus norvegicus*) on December 23, 1931, measured 183.75 u to 195.00 u in length and 86.25 u to 93.75 u in width. The eggs were attached 318.75 u to 393.75 u from the end of the hair roots. It will be noticed that the mite eggs found on the wild rat were attached to the hair 161.25 u to 182.25 u closer to the body. In the case of the white rats which were kept at room temperature the eggs were attached to the hair a greater distance from the animal's body.

Eggs of *Myobia musculi* collected the same time, from the common mouse (*Mus musculus musculus*) measured 168.75 u to 206.25 u in length and 56.25 u to 85.50 u in width. The average length of a number of eggs measured was 182.67 u and the average width was 75 u.

Habitat. These mites are found mostly about the head and neck. They can also be found on the upper part of the shoulders, fore part of the back and the sides of the rats. The young mites hatch from the eggs and go down to the base of the hair. Here they may be seen with the head pointed toward the root of the hair. The special case enclosing the mandibles of young mites was seen extended down along the side of the hair root into the hair follicle apparently for the purpose of feeding. No mites could be found in the hair follicles. In

adult mites the mandibles are not enclosed in the special case as found in the young larvae and nymphs. This conical sucker is lost in the last molt, being no longer needed for feeding purposes.

Some infested rats kept under observation remained infested more than a year at the end of which time they were destroyed. The rats used in the experiment probably became infested in the beginning from wood shavings, stored in a barn, which were used for bedding the rat cages. After this outbreak of acariasis, the wood shavings were dry heated at 110° C. for 24 to 48 hours before being used for bedding. No further infestations occurred. While this species of mite may not be considered of great economic importance, this form of acariasis, nevertheless, deserves consideration when white rats are to be used for research purposes.

DISCUSSION.

The mite found on white rats (*Rattus norvegicus* form *albinus*) described in this paper differs from the mite *Myobia musculi* found on the common house mouse (*Mus musculus musculus*) as described by Claparede (1868). Megnin (1878) (1892) describes *Myobia musculi* (Claparede) found on rats. His description is in accordance with the findings of the writer, but not in agreement with the description as given by Claparede. The eggs of the rate mite described in this paper were found to be slightly larger, also the larvae, nymphs and adults, both males and females are larger than *Myobia musculi* found on *Mus musculus musculus*. The two terminal setae of the rat mite are longer. A notable difference is that the second pair of legs of the rat mite terminates in two claws, whereas the second pair of legs of the mite found on the common house mouse (*Mus musculus musculus*) terminates in one claw. The Myobia found by the writer on the brown rat (*Rattus norvegicus*) were identical with the Myobia found on the white rats. The rat mite studied and described in this paper is clearly distinct from *Myobia musculi* found on the common house mouse (*Mus musculus musculus*), therefore, the name MYOBIA RATTI n. n., is proposed for the mite found on the rat.

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REFERENCES.

Banks, Nathan, 1915.—The Acarina or Mites, U. S. Department of Agriculture, Bureau of Ent. Report No. 108, pp. 29-30.

Claparede, E. 1868.—Studien an Acariden. Verlag von Wilhelm Engelmann, Leipzig.

Ewing, H. E., 1929.—A Manual of External Parasites. Charles C. Thomas, Publisher, Springfield, Illinois, and Baltimore, Md.

Goodall, Thos. B., 1913.—About Acarina—Their Habits, Hosts ,Practical Methods of Examination for, and Life History. The Veterinary Journal, Vol. 69; pp. 224-233.

Greenman, M. J., and F. L. Durring, 1931.—Breeding and care of the Albino rat for Research Purposes. Pub. by Wister Institute, Philadelphia, United States.

Hirst, Stanley, 1922.—Mites Injurious to Domestic Animals, Economic Series No. 13, British Museum (Natural History), London.

———— ———— 1919.—Studies on Acari, No. 1. The Genus Demodex, Owen, British Museum (Natural History), London.

Megnin, Pierre, 1878.—Memoire sur les Cheyletides, Extrait du Journal d'Anatomie et de Physiologie, pp. 15-17.

——— ———, 1892.—Les Acariens Parasites. Encyclopedie Scientifique des Aide—Memoire, Paris. pp. 87-8'.
Osborn, Herbert, 1896.—Insects Affecting Domestic Animals, U. S. Department of Agriculture, Division of Entomology, Bulletin No. 5, New Series, pp. 263-264.
Oudemans, A. C., 1907.—Revision des Cheletines. Mem. Soc. Zool. France, T. 19, pp. 36-218. 66 Figg.
Skidmore, L. V., 1932.—Comparative Study of Acariasis of the White Rat, (Rattus norvegicus form Albinus) (Abstract) Journal Parasit. 19; 172.

A NEW NEOBELLAMIRA (COLEOP.)[1]

BY RALPH HOPPING,

Vernon, British Columbia.

The genus *Neobellamira* was erected by Swaine and Hopping[2] for *Strangalia delicata* Lec., since it was apparently not congeneric with Leconte's genus *Strangalia,* now *Strangalina* Auriv. *Neobellamira* differs not only on the male characters but on the poriferous areas of the distal segments of the antennae which become hardly more than mere punctures or are entirely absent. In *Strangalina* these areas are strongly developed. The first tarsal joint of the hind tarsi is strongly, longitudinally sulcate or grooved, but only feebly so in a few of the *Strangalina*. Casey transferred the genus *Strangalia* of Leconte (*Stragalina* Auriv.) to *Ophistomis* Thoms., but the true *Ophistomis* of Thomson has the front before the eyes very long whereas in *Strangalina* and *Neobellamira* the front is quite short.

Neobellamira delicata Lec.

Length 9-15 mm. This species, the genotype, has the head, antennae, prothorax, mesothorax and metathorax black, the abdomen, rufous and the elytra rufo-testaceous with two converging black lines extending from the base to nearly the middle of the elytra, and just below the end of this line is generally a black spot reaching the elytral margin. The length of the black line varies occasionally, the antennae are dark brown or black and the elytral spot is sometimes missing but otherwise the colour seems to be constant in the foothills of the Sierras. In the desert regions of Palm Springs and Anaheim, California, a wholly rufo-testaceous form has been found with intermediates and specimens with the elytra almost entirely black which, aside from color, cannot be separated, and are here considered only color variations of *Neobellamira delicata* Lec.

Neobellamira sequoiae n. sp.

Length, male 10-11 mm. Rufous, with tarsi, antennae, except the upper surface of the scape, and elytra, except the base and part of the lateral margin, black. The head is sulcate between the eyes and short in front of the antennae, the latter extending slightly beyond the apices of the elytra. The eyes are emarginate and moderately granulate, the prothorax is convex, rufous, with base narrowly margined with black, sparsely punctured, sides sinuate and rather strongly narrowed in front, base strongly sinuate with basal angles rounded. The elytra are black, the base rufous, except the suture, scutellum, and centre of the basal margin black and the sides more or less rufous basally, setigerous punctures sparse and vestiture black and stout. The lateral margins are nearly straight with

[1]Contribution from the Division of Forest Insects, Entomological Branch, Department of Agriculture, Ottawa, Canada.

[2]The Lepturini of America North of Mexico, Swaine and Hopping, National Museum of Canada Bull. No. 52, Bio. Series No. 14, October, 1928, p. 15.

apices obliquely truncate. Legs rufous with tarsi more or less black; abdomen sparsely punctured and extending beyond the tips of the elytra, last ventral very slightly excavated.

Female sightly stouter than the male, antennae rufous and sides of the elytra rufous from the base to two-thirds of the length.

Holotype, ♂, No. 3733 in the Canadian National Collection, F. T. Scott, collector, Sequoia National Park, Calif., 5-1931.

Allotype, ♀, R. Wagner, collector, Sequoia National Park, Calif., 5-10-1930 in the collection of Mr. Roy Wagner, of Fresno, Calif., who very kindly loaned me the specimen.

Paratypes, four males, all from the Sequoia National Park, Calif., collected by Mr. F. T. Scott of Visalia, and Mr. E. G. Linsley of Berkeley, Calif. Six specimens in all have been examined, all from the Sequoia National Park. I am indebted to Mr. Scott, Mr. Linsley and Mr. Wagner for the specimens.

KEY TO SPECIES OF THE GENUS NEOBELLAMIRA.

A. Lateral margins of the apical half of the elytra sinuate with apices rounded *delicata* Lec.

AA. Lateral margins of the apical half of the elytra straight with apices obliquely truncate. *sequoiae* n. sp.

NOTES ON SOME UNCOMMON CRANE-FLIES FROM THE WHITE MOUNTAINS, NEW HAMPSHIRE.

BY CHARLES P. ALEXANDER,
Amherst, Massachusetts.

During the past decade a considerable amount of work has been done on collecting and studying the crane-flies, Tipulidae, of New England. Johnson's basic list of the Diptera of this area (List of the Diptera or Two-Winged Flies. Occas. Papers Boston Soc. Nat. Hist., VII; 1925) recorded 264 nominal species, of which seven have been removed as being synonyms or as being based on mis-determinations. In the intervening years, 73 additions have been made to this list, bringing the corrected total to date to 330 species.

Some of the most interesting of these additions have been made on the Presidential Range of the White Mountains, New Hampshire, particularly at high altitudes on Mount Washington. A few brief facts concerning this area may give a clearer appreciation of the records of Tipulidae to be discussed.

Mount Washington has been defined by several earlier writers as being "an arctic island in the temperate zone." It is located at 44°, 15′ N. latitude, yet has virtually the same climate as northern Labrador, at 60°, or more than 1000 miles to the northeastward. Numerous physical factors are involved in the production of the climate of the alpine zone, the determination of the upper limits of tree-growth, and the final composition of the insect fauna.

The rainfall on the summit and higher levels of the mountain totals as much as 80 inches, or virtually twice that of the surrounding lowlands. Much of this precipitation falls as snow, which is blown by the almost universal westerly and north-westerly winds into one or another of the gulfs and ravines on the lee side of the range, more especially into the Huntington and Tuckerman's Ravines. In the latter, on the southeast side of the mountain, the snow drifts

reach a depth of hundreds of feet and persist as a miniature glacier and finally as a snow-arch until mid-July or even later. The U. S. Signal Service has made a study of the wind velocity and has determined that compared with the reading at sea-coast (Portland, Maine) there is an increase of nine or ten per cent in velocity for each one hundred feet of elevation. This tremendous sweep of wind, at times reaching almost to tornado proportions (to 231 miles per hour), by removing the snow covering, permits deep freezing of the soil and a subsequent dry-killing of plant life in winter The settling of cold air in the glacial ravines, such as Tuckerman's, chills the surroundings and seriously affects forest growth, moreover being largely responsible for late spring and early fall frosts. The culmination of all of these unfavorable factors has definitely limited the timber-line, this being at a slightly higher altitude on the easterly slopes than on the westerly. Above the limits of tree-growth is fell-field, a rocky flat or plateau. the vegetation consisting of a diversified flora of dwarf size, with an abundance of lichens and mosses. The Alpine Garden, above the rims of Huntington and Tuckerman's Ravines, and Bigelow's Lawn, on the col between the cone of Washington and Boott Spur, are examples of fell-fields on the Presidential Range.

The Tipulidae so far discovered at and above 5000 feet on Mount Washington are all Arctic or Hudsonian forms, or else are endemic species, not known elsewhere.

A few of the rare species that were secured in 1932 and 1933 may be discussed briefly.

1. *Tipula* (*Schummelia*) *idei* Alexander. Known from the Hudsonian zone in Ontario and Quebec. A male taken on the Tuckerman Trail, 2700 feet, July 4, 1933, by Mr. Walter Harrison. A second male by the writer at 2800 feet, July 7, 1933.

2. *Tipula* (*Oreomyza*) *nebulipennis* Alexander. Known from Labrador and the Hudsonian zone of North Gaspe, Quebec. A male along Carriage Road, 4700 feet, by Mabel M. Alexander, July 8, 1933. A second male found in my coffee cup in the Lakes of the Clouds hut, 5000 feet, on the night of July 8, 1933.

3. *Nephrotoma penumbra* Alexander. Described from the high summits of Mount Washington and nearby peaks, and still known only from this immediate vicinity. Very abundant on morning of July 9, 1933, on slopes of Monroe and Washington, above 5000 feet. A teneral specimen was found just emerging from its pupal skin that protruded from a cushion of *Diapensia*. This is the most common and characteristic crane-fly of the alpine summits of the Presidential range.

4. *Dicronota* (*Rhaphidolabis*) *petiolata* (Alexander). Described from the Hudsonian zone of the Rocky Mountains, Colorado. Later found under similar Hudsonian conditions on cliffs along the north shore of Gaspe, Eastern Quebec. A male taken just at summit of headwall of Tuckerman's, altitude 5000 feet, August 24, 1932.

5. *Pedicia* (*Nasiternella*) *hyperborea* (Osten Sacken). Originally described from a single male specimen taken in Labrador. The only other published record was of a small series of males, taken July 21, 1875, by Mr. George Dimmock, at the Camp of the Cambridge Entomological Club, on Chandler Ridge a short distance below the Half-way House on Mount Washington. This camp has been

well described and figured by Emerton (Psyche, 31:1-6, fig. 1; 1924).

This species has always been one of the rarest and most desirable of all American crane-flies. A slightly more detailed account of its re-discovery on the Mountain in 1933, and of the finding of the hitherto unknown, almost wingless female, may be of interest.

Our party, consisting of Mr. Walter Harrison, botanist and naturalist, and of Mrs. Alexander and myself, was progressing slowly up the Tuckerman Trail, when at 2700 feet my wife captured a fine male of a Tipulid new to her, and which upon examination proved to be the lost *P. hyperborea*. I at once began sweeping all the herbage and shrubbery along the mountain streams, but before I was able to find a single specimen, Mrs. Alexander had located three or four more, all males. In the dense balsam forest at about 3800 feet, between Hermit Lake and the floor of the ravine, we finally found a dozen or so males. The forest floor is strewn with great boulders, thickly carpeted with mosses and lycopodia, and with an abundance of *Chiogenes, Oxalis, Acetosella, Clintonia,* and other characteristic Canadian and low Hudsonian plants. Characteristic breeding birds of this spot were hermit thrush, winter wren, and blackpoll warbler. The specimens of *hyperborea* found that day were all males, all behaving quite differently from any other member of this tribe (Pediciini) in their habits of searching for the females. Those found were crawling continually about over the prostrate rotting logs, progressing by a fluttering motion, part walking, part flying. They were so sluggish or intent that they were most readily captured by merely picking with one's fingers. Only rarely did they take flight, and then low over the ground. This habit is eminently characteristic of males in the crane-fly genera *Tipula* and *Limnophila* having subapterous females, and we at once became suspicious that the unknown female might prove to be flightless. The following day, July 4, we confirmed this idea by finding a male in copula with a still teneral female. In this sex the wings are greatly reduced but still showing the characteristic venation of the subgenus.

As a summary, we found the species on these two days at altitudes of between 2700 and 4000 feet, along this trail and a side trail to the Lion's Head. It seems certain that the immature stages live beneath the thick layers of moss, possibly in the saturated wood of prostrate logs. The males are always most in evidence where there is a dense carpet of mosses and shiny clubmosses. On July 8, Mrs. Alexander found still another male, being buffeted by the wind along the Carriage Road at 4200 feet. It should be noted that only one other genus of Tipulidae (*Chionea*), in northeastern North America is subapterous in either sex.

In addition to the above, mention might be made to two other Tipulidae, both still known only from unique types taken in the White Mountains. Constant search in recent years has failed to reveal these two flies.

Tipula (*Oreomyza*) *insignifica* Alexander. Alpine Garden, Sept. 21, 1919; collector unknown (Boston Society Natural History).

Dicranota (*Eudicranota*) *pallida* Alexander. White Mountains, collected by Morrison, presumably in 1874 or 1875 (United States National Museum).

A NEW NAME FOR ATAENIUS CONSORS FALL (SCARABAEIDAE, COLEOPTERA).

BY HOWARD E. HINTON.

Berkeley, California.

Ataenius falli Hinton, new name.

Ataenius consors Fall, Jour. N. Y. Ent. Soc. Vol. XXXVIII, p. 104, 1930.

This species, which has masqueraded in collections for many years as *Ataenius strigatus* Say, has been recently described by Mr. Fall as *A. consors*. The latter name is unfortunately preoccupied by *Ataenius consors* Blackb. (Proc. Roy. Soc. Vict. XVII, 1904, p. 161 u. 168.), and the species is here renamed *A. falli* as a slight tribute to Mr. Fall for his contributions to our knowledge of this difficult group.

ON THE STABILIZING OF FOUR GENERIC NAMES (LEPID.: RHOPALOCERA).

To students of the involved generic nomenclature of the Palaearctic and Nearctic Diurnal Lepidoptera, the recent publication of the "Generic Names of British Rhopalocera" will prove of great interest. This pamphlet has been prepared by Mr. Francis Hemming at the request of the Committee on Generic Nomenclature of the Royal Entomological Society of London, and includes full details regarding type fixation and synonymy. Appended to the list is the first report of the Lepidoptera Sub-committee to the main committee, and following Mr. Hemming's suggestions, the suspension of the Law of Priority in four cases is advocated by this subcommittee, the grounds being that strict application of the rules would cause serious, and quite unnecessary, disturbance in existing practice.

The genera involved, with their proposed genotypes, are as follows:

Argynnis Fabr. (*P. paphia* Linn.); *Vanessa* Fabr. (*P. atalanta* Linn.); *Strymon* Hbn. (*S. melinus* Hbn.); *Colias* Fabr. (*P. hyale* Linn.).

Welcoming any action that would assist in stabilizing generic Nomenclature, the undersigned lepidopterists express their full agreement with the recommendations of the above subcommittee and would urge the adoption of this report.

E. L. BELL, J. A. COMSTOCK, C. H. CURRAN, W. T. M. FORBES, J. D. GUNDER, E. I. HUNTINGTON, A. B. KLOTS, J. MCDUNNOUGH, C. J. DOS PASSOS, F. E. WATSON, R. C. WILLIAMS, JR.

BOOK NOTICES.

Jungle Bees and Wasps of Barro Colorado Island, Panama, by Phil Rau. Published by Phil Rau, Kirkwood, Mo., 1933. Price $2.75.

Bumblebees and Their Ways by O. E. Plath, M. A., Sc. D. Macmillan Co., New York, 1934. Price $4.00.

The above two works form a fascinating and most interesting addition to our knowledge of the habits of wild bees and wasps and should be indispensable to all students of insect behaviour. A wealth of detail is presented in a most attractive manner and numerous excellent illustrations add to the enjoyment of the reader.

Studies in North American Trichoptera, 1. By Lorus J. Milne, Cambridge, Mass., April, 1934; 19 pp., small 8vo. (For sale by author, 50c, postage extra; Viol. Inst., Harvard Univ., Cambridge, Mass.)

Keys to N. A. genera and species of *Phryganeidae, Molannidae* and *Leptoceridae;* check-lists of world *Phryganeidae* and *Molannidae* and of N. A. *Leptoceridae,* each with only the N. A. synonymy. Three new genera, five new subgenera, three new species, four new subspecies, one new name; five old genera resurrected, nine types of old genera elected; thirty new N. A. synonyms quoted, from study of the type material in the museum of Comparative Zoology, of Hagen's and Banks' names.

Date Mailed, June 1, 1934.

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